

Chapter 2 Agency Proposed Action and Alternatives

In this Chapter:

- **Agency Proposed Action**
- **Three Action Alternatives**
- **No Action Alternative**
- **Alternatives Eliminated from Consideration**
- **Comparison of Alternatives and Summary of Impacts**

BPA and LVPL have been studying ways to reinforce the transmission system that serves the Jackson and Afton, Wyoming areas. BPA and LVPL completed long-term (15-30 year) studies and developed alternatives that would reinforce the transmission system. Each alternative has different components and ability to solve the problem. This chapter describes the alternatives, summarizes how the environmental consequences differ among alternatives, and compares the alternatives against decision factors. BPA and the USFS are considering the Agency Proposed Action, and four alternatives including the No Action Alternative.

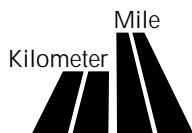
► For Your Information

NEPA requires that proposed major federal actions which may have significant impacts on the environment be examined in an environmental impact statement. NEPA helps public officials make decisions that consider environmental consequences.

Regulations implementing the National Environmental Policy Act (**NEPA**) require federal agencies to analyze the consequences of taking no action, in this case, continuing to operate the transmission system under present conditions.

This chapter also describes other alternatives, such as burying the transmission line, that have been suggested but eliminated from detailed consideration for technical and/or economic reasons. (See Section 2.6, **Alternatives Considered and Eliminated from Detailed Consideration.**)

BPA uses metric measurements to comply with Public Law 100-418. See metric conversion chart on the inside of the back cover.



*Please refer to Sections 1.4, **Finding Solutions** and 1.7.1, **Long-Range Planning** for discussions of long-term planning and future planning actions.*

2.1 Agency Proposed Action

In the Agency Proposed Action, BPA and LVPL would construct a new 115-kV line from BPA's Swan Valley Substation near Swan Valley in Bonneville County, Idaho about 58 km (36 miles) east to BPA's Teton Substation near Jackson in Teton County, Wyoming. (See Map 1.) The Agency Proposed Action has the following components and would cost about \$14,500,000 (1997 dollars). The cost, including all potential future planning actions, is estimated to be \$19,400,000 (1997 dollars) over 30 years.

► For Your Information

A **single-circuit** line has one electrical circuit on one structure.

Structure numbers refer to a specific structure in a given mile (from west to east) of the existing Swan Valley - Teton No. 1, 115-kV transmission line. For example, a road near structure 6/2 is near the second structure in mile six of the existing line east of Swan Valley Substation.

A **double-circuit** line has two separate electrical circuits on the same structure.

A right-of-way is an easement over the land of another owner. The exact amount of right-of-way cleared varies at any point and mostly depends on slope, tree height and growth rate, and line height. This variation in clearing requirements gives the ROW a scalloped or feathered appearance. BPA anticipates that about 73 hectares (181 acres) of clearing could occur for the Agency Proposed Action. Because clearing would be done in the national forests, location and amounts of clearing would be coordinated with the Forest Service.

2.1.1 Transmission Line

A new 115-kV line would be built next to the existing Swan Valley-Teton No. 1, 115-kV transmission line wherever feasible (see Section 2.1.2). Most of the new line would be supported by a mix of **single-circuit** wood pole H-frame structures and lattice steel structures. (See Figure 2-1.) Steel structures are generally stronger than wood structures and would be used in areas where greater strength is needed, such as in steep areas, or for long spans over deep canyons.

At Teton Pass (**structure numbers** 28/1 to 29/3), and coming off Phillips Ridge into Teton Substation (structure numbers 34/6 to 36/5), **double-circuit** structures would be used. These are shown in Figure 2-2 and their general location on Map 2, **Sample Structure Locations**.

2.1.2 Additional Right-of-Way

About 23 m (75 feet) of additional ROW width would be needed for the new structures and line. In areas where double-circuit structures would be used, no additional ROW would be needed. New ROW is proposed for the north side of the existing ROW except for the following areas:

- Through the Swan Valley area and into the mouth of Pine Creek (Swan Valley Substation to structure 6/1), the new ROW could be east or west of the existing line.
- From structures 6/1 to 7/2, BPA is considering several routing options described below (and shown in Figure 2-3).
- Through the Pine Creek area to the Idaho State Route 33 crossing (between structures 7/3 and 21/4), the new line would be south of the existing ROW.

2.1.2.1 Pine Creek Routing Option A

BPA (from structures 6/1 to 7/2), would place the new transmission line north of the existing line, up the hill about 244 m (800 feet) or more.

2.1.2.2 Pine Creek Routing Option B

BPA would place the new transmission line next to and north of the existing line from structures 6/1 to 7/2.

Figure 2-1. Existing and Proposed Single-Circuit Structures and Right-of-Way

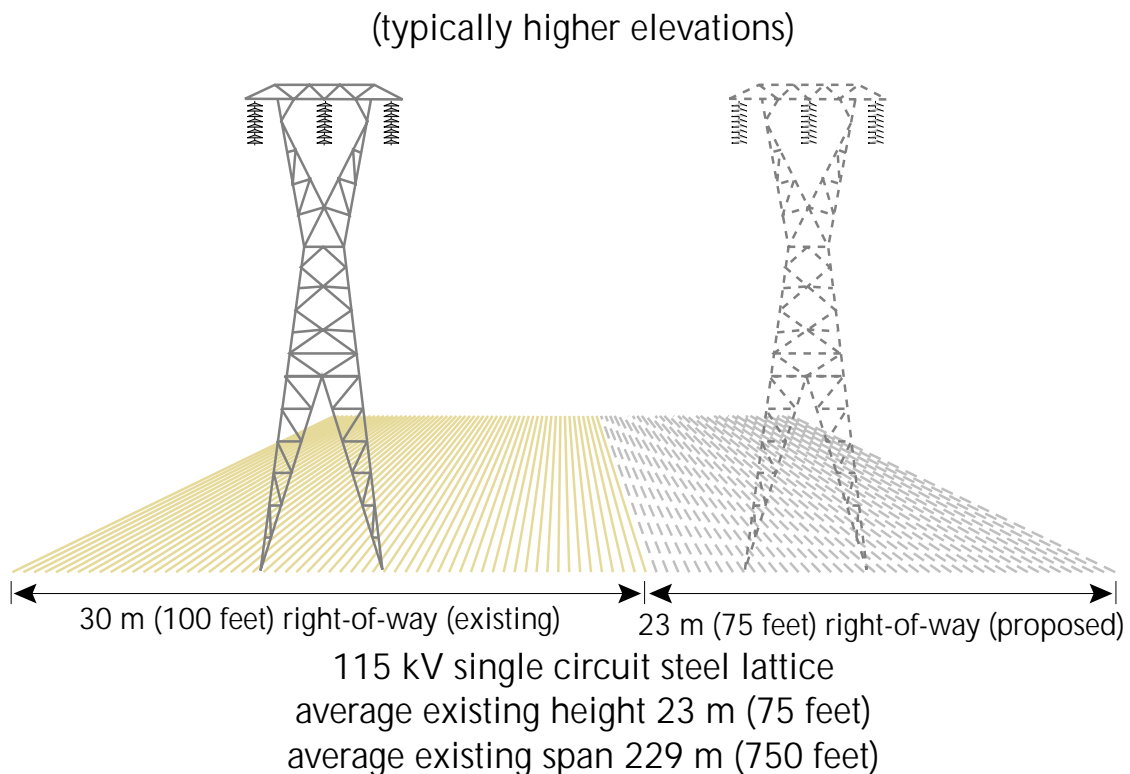
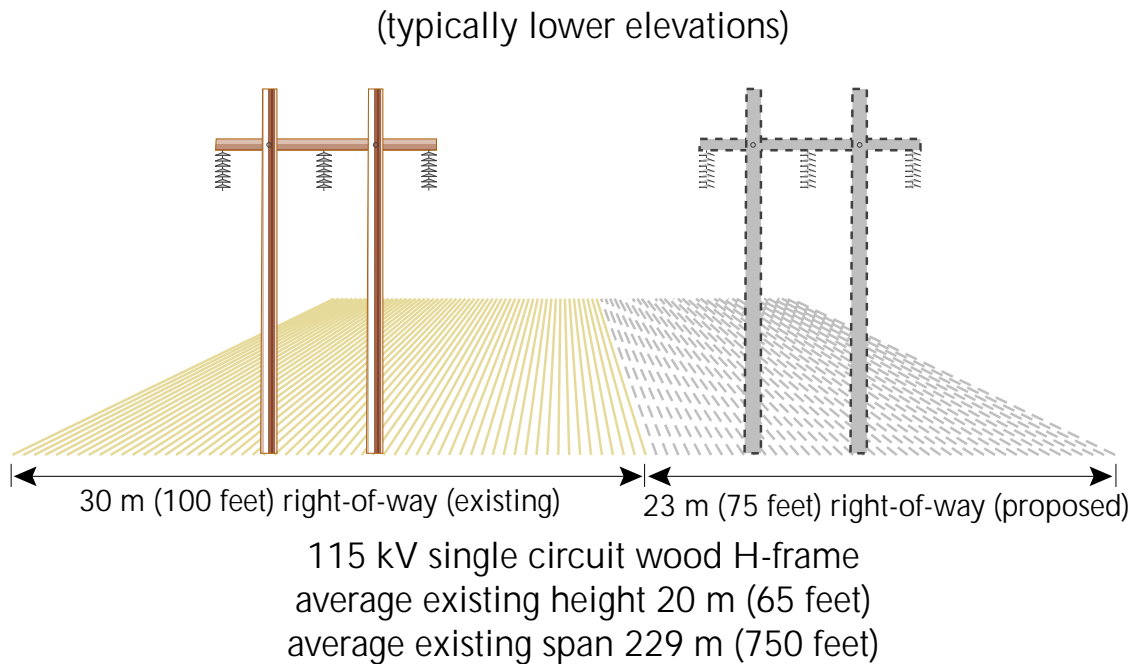
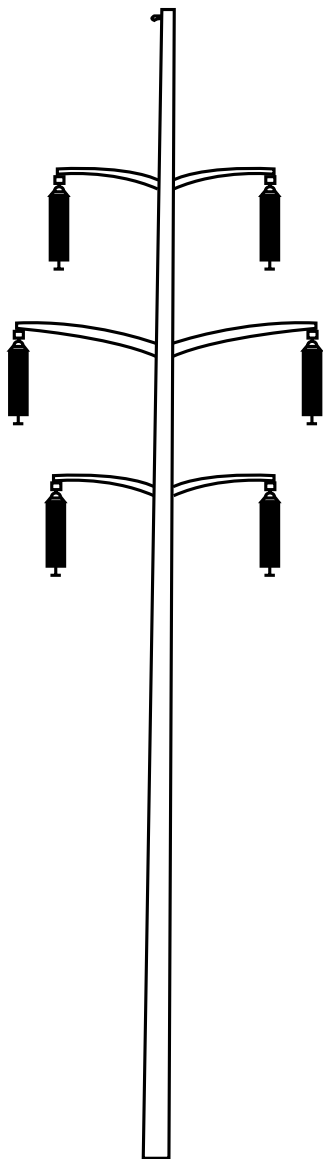
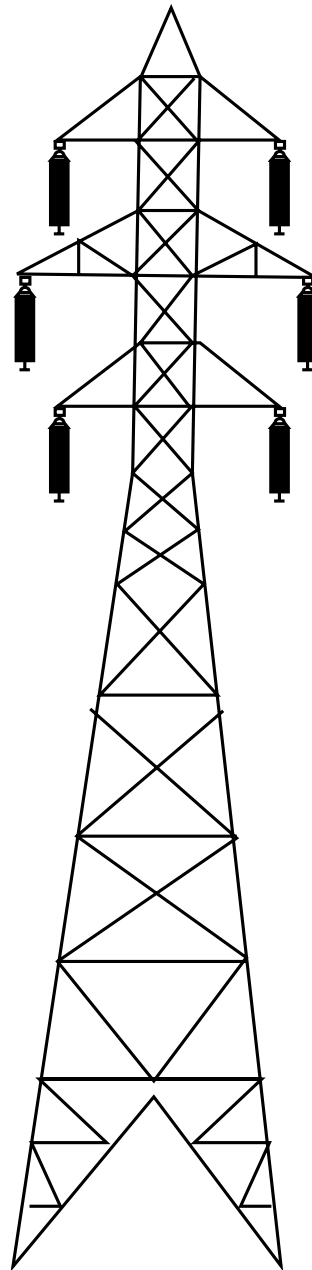


Figure 2-2. Proposed Double-Circuit Structures



115-kV steel pole
average height 27 m (88 feet)
average span 274 m (900 feet)



115-kV steel lattice
average height 29 m (96 feet)
average span 366 m (1200 feet)

2.1.2.3 Pine Creek Routing Option C

BPA would cross the highway at structure 6/1, route the line on the south side of Pine Creek up the hill behind the old ski lodge, and tie into the existing ROW at structure 7/2 on the south side of the existing ROW.

► For Your Information

*BPA improves **access roads** by grading, improving drainage, and adding gravel to the road surface. After construction, roads are maintained for emergency access and maintenance.*

Location and design of new roads are typically done during or after final design of the transmission line. Because some new access roads would be in national forests, their location and design would be closely coordinated with the Forest Service.

2.1.3 Access Roads

BPA normally acquires rights and develops and maintains permanent overground access for travel by wheeled vehicles to each structure. Roads are designed for use by cranes, excavators, supply trucks, boom trucks, and line trucks for construction and maintenance of the transmission line. Truck size and carrying weight help determine road specifications. BPA prefers road grades of 6 percent or less for highly erodible soils (silts), and 10 percent or less for erosion resistant soils (earth and broken rock). For short distances, maximum acceptable road gradients are 15 percent for trunk or main roads, and 18 percent for spur roads (the roads that go to each structure if it is not located on a trunk road).

Most of the new line could be built using existing access roads. Existing roads and structures accessible by road are listed in Table 2-1. Table 2-1 also identifies which access roads could be closed in exchange for better access and which roads may need gates, culverts, or bridges. A full field survey of the existing and required new access would be done prior to construction and may result in changes to the summary shown in Table 2-1.

About 8-16 km (5-10 miles) of new access road (not including spur roads) would be needed for construction and maintenance for the new and existing lines. Those portions of existing ROW that do not have access are from structures 6/2 to 6/9, 8/7 to 8/10, 9/5 to 10/2, 23/5 to 24/3, 24/6 to 26/7, and 29/1 to 29/3. The easements for new access roads outside the existing ROW would be 15 m (50 feet) wide. New or existing roads would be graded to provide a 4.2 m (14 foot) travel surface, with an additional 1.2-1.8 m (4-6 feet) to accommodate curves. About 3 m (10 feet) on both sides of the road would be disturbed for ditches, etc.

2.1.4 Gates

Access roads that cross private land and land managed by the Forest Service are typically gated and locked by BPA. Gates are constructed of heavy pipe and painted to the landowner's or land manager's preference. All parties that have a right to use the road would have access to it. At this time, BPA estimates installing about 19 gates.

Table 2-1. Existing Access Roads and New Access Roads Required**► For Your Information**

This table lists existing BPA access roads. Some roads are also USFS roads and are identified as such in the table.

Structures	Accessed by:	Notes
1/1-1/3	Road 1-1,1-2	
1/4-3/7	Bonneville County Rd.	
4/1-4/4	Bonneville County Rd.	May need access road from 4/2 to 4/3.
4/5-4/7	Road 4-1	
4/8-5/6	Road 5-1	
5/7-6/1	Road 5-2,5-3,5-4	
6/2-6/9	No access roads here	Steep terrain and potential rock slides may prevent road construction along existing ROW. BPA may use helicopter and manual construction techniques and skid poles up from the highway, or build new line farther uphill and build an access road from Road 6-1 and loop down the slope from above. Another option is to route new line to an area with better access.
6/10-6/12	Road 6-2	
7/1-8/1	Road 7-1,7-2	BPA would like to exchange a portion of this access road for access from Pine Creek Lodge. Bridge by Pine Creek Lodge is okay for construction.
8/2-8/6	Road 8-1, 8-2 (USFS 250)	BPA would need to replace bridge for construction.
8/7-8/10	No access roads here	BPA would need to develop access road to structures.
8/6-9/4	Road 9-1,9-2,9-3	A temporary or permanent bridge would be used for construction. The ford on 9-3 would be hardened for maintenance. Creeks have been recently culverted by Forest Service.
9/5-10/2	No access roads here	BPA would need to develop access road to structures.
10/3-11/6	Road 10-1, 10-2,10-3,11-1, 11-2,11-3 (USFS 252),11-4	BPA may want to exchange access on 10-3 for new access farther east opposite 11/2. A new bridge would be required. Bridge on 11-3 would be replaced for construction.
12/1-14/6	Road 12-1, 12-2,12-3,12-4, 12-5,13-1,13-2, 13-3,13-4,13-5, 13-6,13-7(USFS 253),14-1, 14-2,14-3,14-4, 14-5	BPA would gate 13-6 and 13-7.

Table 2-1. continued

Structures	Accessed by:	Notes
15/1-18/2	Road 15-1, 15-2,15-3,15-4, 16-1,16-2,17-1	BPA would install culverts and gates on 15-3 and 15-4. BPA may need to exchange access on 15-3 for private road to east opposite 15/4. If 15-3 is used for construction, the ford would be replaced with a bridge or large culvert. BPA would install a gate on 17-1.
18/3-18/4	Road 18-1	
18/5-21/2	Road 18-2,18-3, 18-4,19-1,21-1,21-3	BPA would gate 18-2, 21-1.
21/3-23/4	Road 21-2,22-1, 22-2,22-3,22-4	BPA would keep new right-of-way and new roads out of Wilderness Area. Gate 21-2. BPA may need new access road from Hwy. 22 to 23/1.
23/5-24/3	No access roads here	BPA would need to develop access roads.
24/4-24/5	Road 24-1,24-2,24-3	
24/6-26/7	No access roads here	BPA would need to develop access roads.
26/8-27/6	Road 27-1,27-2	
27/7	Access from Hwy. 22	
28/1	Access from Hwy. 22	
28/2-28/5	Road 28-1	
29/1-29/3	No access roads here	BPA would need to develop access roads or use helicopter for construction.
29/4-30/4	Road 29-1,29-2, 29-3,30-2	Abandon 30-1.
30/5-33/8	Road 31-1,31-2, 32-1,32-2,32-3	
34/1-35/1	Road 34-1,34-2,34-3, 35-1-R	Road is washed out; will take major reconstruction effort.
35/2-35/5	Access from Fish Creek Road	BPA would need to install culverts or a temporary bridge.
35/6-36/5	Access from Moose Wilson Road	BPA would need to construct a temporary bridge west of 35/8 to access structures 35/7 and 35/6, or develop a new access road from residences to the south.

2.1.5 Line Termination and Equipment

The new line would terminate at Swan Valley and Teton substations. Terminating a line requires special types of equipment. The new equipment would be placed on BPA property. All equipment would be placed within the substation yard at Teton Substation. The fenced yard at Swan Valley Substation would be expanded east into an existing parking lot.

The following equipment would be installed at Swan Valley and Teton substations. Some of the equipment is shown as existing equipment in Figure 2-4.

Power Circuit Breakers — A breaker is a switching device that can interrupt a circuit in a power system during overload or fault conditions. Faults are caused by lightning, trees falling into the line and other unusual events. Several kinds of breakers have been used in substations. The breakers planned for this project, called gas breakers, are insulated by special non-conducting gas (sulfur hexafluoride). Small amounts of hydraulic fluids are used to open and close the electrical contacts within gas insulated breakers. The hydraulic fluid is the only toxic or hazardous material that would be used. One breaker would be installed at each substation.

Substation Dead Ends — Dead ends are structures within the confines of the substation where incoming and outgoing transmission lines end. Dead ends are typically the tallest structures in a substation. Both substations will require a new substation dead end. At Teton Substation, the existing deadends are 16.5 m (54 feet) high.

Transmission Line Dead End — The last transmission line structure on both the incoming and outgoing sides of the substation are called dead end structures. These structures are built with extra strength to reduce conductor tension on substation dead ends and provide added reliability to the substation. The single wood pole structure inside the Teton Substation is 20 m (65.5 feet) high. Both substations would require a new transmission line dead end. At Teton Substation, the dead end would be a single wood pole structure.

► For Your Information

Ground wire is wire that is strung from the top of one structure to the next; it shields the line against lightning strikes.

Ground wire — An overhead **ground wire** would be placed about 3 m (10 feet) above the transmission line out of Swan Valley Substation for about 1.6 km (1 mile), and about the last 1.6 km into Teton Substation to protect the line and substations from lightning strikes. BPA and LVPL are still considering installing ground wire along the entire line.

Substation Fence — This chain-link fence with barbed wire on top provides security and safety. Space to maneuver construction and maintenance vehicles is provided between the fence and electrical equipment.

Substation Rock Surfacing — An 8-cm (3-inch) layer of rock selected for its insulating properties is placed on the ground within the substation to protect operation and maintenance personnel from electrical danger during substation electrical failures.

Disconnect Switches — Switches are devices used to mechanically disconnect or isolate equipment. Switches are normally placed on both sides of circuit breakers. Three new switches would be installed at each substation.

Bus Tubing, Bus Pedestals — Power moves within a substation and between breakers and other equipment on ridged aluminum pipes called bus tubing. Bus tubing is elevated by supports called bus pedestals.

2.1.5.1 Underground Line Termination Option at Teton Substation

This option would place the last 122 m (400 feet) of new transmission line underground into Teton Substation. The last double-circuit steel pole structure would branch into two wood pole structures. These poles would be about 6 m (20 feet) higher than the last existing wood pole H-frame structure (which is 17 m [57 feet] high) located on the west property line. Electrical equipment would be placed below one of the new wood pole structures to allow the new line to transition from overhead to underground. From that point, the line would stay underground about 122 m (400 feet) and surface in the new bay, west of the existing **bays**. No new substation and transmission line dead-end structures would be needed and the tallest piece of equipment in the new bay would be under 6.7 m (22 feet).

► For Your Information

A **bay** is an area set aside in a substation for special equipment.

This option could cost about \$250,000 depending on final design specifications and cost of cable, hardware and labor.

2.1.6 Communication Equipment

BPA has an existing communications network in place that delivers signals from control centers to operate substation equipment in remote locations. This network also provides voice communication for substation operators and maintenance personnel. BPA uses a combination of fiber optics, microwave, and radio communication at Swan Valley Substation. For Teton Substation, BPA uses the transmission line as a carrier for communication signals.

BPA is considering installing fiber optic cable on the new line for communication. Fiber optics transmit messages using light pulses. Glass fibers, which are almost as thin as human hair, carry the light pulses. Glass fibers are wrapped in polyurethane sheaths and are grouped in cables. The cables would be installed on the new transmission structures and new telecommunication

equipment would be placed in the substation control house. If ground wire is installed along the entire line, the fiber optic cable could be contained within the ground wire.

2.1.7 Maintenance

BPA would perform routine, periodic maintenance and emergency repairs on structures, substations, and accessory equipment. These activities typically include replacing poles, crossarms, and insulators. Within substations, BPA may need to replace equipment periodically. If BPA develops access to most or every structure, this access would remain through the life of the line so BPA can perform routine and emergency maintenance. Maintenance activities include grading, clearing and repairing ditches, and other typical road work.

Another large part of maintenance activities is vegetation control. During the final design phase before construction, clearing specialists use aerial photographs and computer simulations to develop a clearing plan for the project. Specialists consider the kind of line, the height and growth habits of the vegetation, slope, allowable conductor height, and conductor swing including wind and snow patterns, to determine which vegetation must be removed.

After construction, maintenance crews assume responsibility for the line. This includes controlling *noxious weeds*, and managing for tall growing vegetation in and adjacent to the ROW. A new ROW Management Plan would be developed within a year of project completion that addresses how BPA would maintain the line, including methods used to manage vegetation. At that time BPA would work with the Forest Service to identify the manual, mechanical, biological, and chemical methods needed to manage vegetation. Additional site-specific environmental work would be completed at that time.

2.2 Single-Circuit Line Alternative

The Single-Circuit Line Alternative has all the components of the Agency Proposed Action except the entire line would be supported by the single-circuit structures shown in Figure 2-1. There would be no double-circuit structures and the entire line would be located on the north side of the existing ROW. Also, this alternative does not include the Pine Creek Routing Options or the Underground Line Termination Option at Teton Substation.

This alternative would cost about the same as the Agency Proposed Action (\$14,200,000 [1997 dollars]). There would be some cost savings from not using double-circuit structures but that may balance out with having to get additional ROW easements for

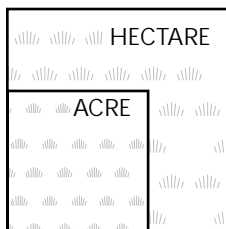
► Reminder

Please refer to Sections 1.4, **Finding Solutions** and 1.7.1, **Long-Range Planning** for discussions of long-term planning and future planning actions.

► For Your Information

Tap - The point at which a transmission line is connected to a substation or other electrical device to provide service to a local load.

► Reminder



Hectare: about two and one-half acres

the single-circuit structures. The cost including all potential future planning actions is estimated to be about \$ 19,100,000 (1997 dollars) over 30 years.

2.3 Short Line Alternative

The Short Line Alternative has all the components of the Single-Circuit Line Alternative from Targhee **Tap** to Teton Substation. BPA and LVPL would construct the new line from Targhee Tap near Victor in Teton County, Idaho 29 km (18 miles) east to Teton Substation (see Map 1). Like the Single-Circuit Line Alternative, all new structures would be single-circuit (shown in Figure 2-1) and the new ROW would be located on the north side of the existing ROW.

BPA would also construct a new switching station near the existing ROW north of Targhee Tap. Targhee Tap would then be removed. A potential new station site is shown on Map 1. The new switching station would cover about 0.4 hectares (1 acre) and would be similar to Teton Substation, which has three bays now and would add one more. BPA would purchase about 1-2 hectares (3-5 acres) of agricultural land. A parking area, entrance road, electrical service, and a small control house would also be needed. These are described below.

This alternative would cost about \$11,100,000 (1997 dollars). The cost including all potential future planning actions is estimated to be about \$19,300,000 (1997 dollars) over 30 years.

Substation Entrance Road — Substation entrance roads are high-quality roads for construction, operation and maintenance crews and their equipment to access the site. Some of the electrical equipment installed at the substation is very heavy and construction and maintenance trucks have wide turning radii. An 18-m (60-foot) road right-of-way would be acquired. A 6-m (20-foot) wide rock road surface with 1.5-m (5-foot) wide shoulders would be needed for the road.

Electrical Service — Electrical needs at the switching station would be supplied by BPA or the local utility. The existing distribution system serving the area would need minor equipment adjustments that depend on the site selected for the new switching station.

Control House — Equipment that is used to perform certain functions at a substation can be housed inside a small building called a control house. Equipment might include fans, and communication and computer equipment.

► For Your Information

A **var** is a unit of measurement of reactive power in a circuit.

Thyristors are semiconductor switches.

2.4 Static Var Compensation Alternative

BPA would install a Static **Var** Compensator (**SVC**) at Teton or Jackson substations. (See Map 1.) An SVC is a group of electrical equipment placed at a substation to help control voltage on a transmission system. Equipment includes a transformer, capacitors, reactors, **thyristor** valves, a cooling system, and computer controls. Some components are housed together in a small building at the substation and others remain outside in the substation yard.

Teton Substation is the preferred location for the SVC because it is BPA-owned, easier to access and maintain, has existing communication facilities, and can house the SVC without BPA buying additional property. Jackson Substation is owned by LVPL and would need to be expanded about 0.2 hectare (0.5 acre) to house the new facility.

This alternative would cost about \$6,200,000 (1997 dollars). The cost including all future planning actions is estimated to be about \$20,100,000 (1997 dollars) over 30 years.

A portion of the west fence line at Teton Substation would be moved on existing BPA property for the following new equipment, which would require about 46 m x 46 m (150 feet x 150 feet) of added space. (See Figure 2-4.) If chosen, Jackson Substation would require the same equipment.

Transformer — A transformer is a device for transferring electrical energy from one circuit to another. A new 30-70 megavolt ampere (**MVA**) 115-kV transformer would be installed.

Shunt Capacitors — Shunt capacitors are generally located in substations and used to increase the voltage at the end of a line. Three new 25 MVar capacitor groups would be installed at the north end of Teton Substation, west of the existing two capacitor groups.

Reactors — Reactors are devices used to control voltage. Three reactors would be installed at the southwest end of Teton Substation.

Thyristor valves — Thyristors are semiconductor switches. Three valves would be installed between the transformer and the reactors.

Control House — An additional small control house would be installed to house the computer controls and cooling system.

2.5 No Action Alternative

The No Action Alternative is traditionally defined as the no build alternative. This No Action Alternative assumes that no new transmission line is built, and no other equipment is added to the transmission system. The existing transmission line and substations would be operated and maintained as they are now.

2.6 Alternatives Considered and Eliminated from Detailed Consideration

BPA and LVPL studied a variety of alternatives to meet the need. After study, the following alternatives were eliminated from further consideration because they either could not meet the need for the project or they were considered unreasonable.

2.6.1 Conservation

Conservation was suggested as an alternative during the scoping process. Conservation programs are typically used to solve problems and modify electricity use patterns in limited geographic areas at specific times of the day and year.

► For Your Information

*An **average megawatt** is the unit of energy output over a year, equivalent to the energy produced by the continuous operation of one megawatt of capacity over a period of time.*

LVPL has participated in conservation programs, many sponsored by BPA, since 1983. Programs have accomplished electrical savings of 3.305 **average megawatts (aMW)** (see Table 2-2). BPA no longer provides conservation funding to LVPL, but

Table 2-2.
Conservation Programs
in the LVPL Service Area

Program	aMW Savings
Weatherwise (residential retrofit)	0.2356
Super Good Cents	0.3456
Water Heaters	0.0379
Shower Heads	0.1593
Aerators	0.2284
Energy Smart Design (new and existing commercial)	0.1256
Energy Saving Plan (industrial)	1.083
Solar Water Heaters	0.0077
Waterwise (Irrigation)	0.0067
Street and Area Lighting	1.075
Total	3.305

LVPL is working with the Town of Jackson Building Department to develop building codes that include conservation measures such as increased insulation in buildings.

Though conservation programs do reduce the need for power in the area, the magnitude of energy savings that can be accomplished is too small (less than one year of load growth) to defer the need for system reinforcement. Also, load projections include conservation savings. Still load growth has far outpaced the energy savings and the total load cannot be kept below the present system limit of 125 MW.

Because conservation programs cannot meet the need, they were eliminated from further consideration.

2.6.2 Transmission System Plans

BPA's and LVPL's initial study identified transmission plans that could potentially meet the need. Another transmission plan was suggested during scoping. These plans contain many actions over the 30-year planning period at and between different substations in northeastern Idaho and western Wyoming; the major actions are described in Section 2.6.2.2, **System Plans**.

After engineers studied the plans, they were eliminated from further consideration because of high cost.

2.6.2.1 Cost Considerations

BPA is mandated by the Northwest Power Act to recover its costs sufficiently to repay the U.S. Treasury after first meeting its other costs. The electric energy industry is changing rapidly, with increased competition that has lowered the price of power and transmission services from BPA's competitors. As the electric industry changes, BPA must be able to recover its costs and compete with other suppliers in the western United States. BPA must balance its responsibilities to its ratepayers, customers and the environment and set its rates at the lowest possible level consistent with sound business principles. BPA looks for alternatives that would help keep its rates low. Alternatives that may meet the need, but that have costs sufficiently greater than other alternatives were eliminated from consideration to respond to BPA's need to remain competitive in the long term.

LVPL, in order to stay competitive with other public utilities, also needs to make sound financial decisions. Like BPA, they will consider alternatives that meet the need for the project but will eliminate those with relatively higher costs.

Table 2-3. LVPL and Utility Cooperatives Average Debt Ratios

Ratio Type	Co-op Average	LVPL	with additional \$10,000,000 debt
Total Debt to Total Asset	5%	58%	64%
Long-Term Debt to Total Asset	49%	48%	55%
Long-Term Debt to Total Capitalization	47%	60%	67%
Total Debt to Total Capitalization	50%	73%	77%
Times Interest Earned	1.97	1.98	not applicable

If LVPL wanted to borrow the full amount to pay for an alternative that costs \$10,000,000, the utility would use common electric industry debt ratios as a guide for weighing the financial impact. Table 2-3 lists these ratios as percentages for LVPL, compares them to an average figure for other utility cooperatives, and then shows the change when \$10,000,000 of debt is added.

The first ratio, *Total Debt to Total Asset*, measures how much of the utilities total assets have been financed using borrowed money (both in the short and long term). The higher the percentage, the more other people's money is being used to generate profits. At the end of 1995, LVPL had financed 58 percent of its total assets with borrowed money. Choosing an alternative that costs about \$10,000,000 would raise this percentage to 64 percent. The average 1994 percentage for utility cooperatives is 5 percent. The 1994 data is the most up-to-date data available but the averages do not change much from year to year with so many utilities included in the average.

The second ratio, *Long-Term Debt to Total Asset*, is similar to the first ratio but only looks at long-term debt used to finance assets. This ratio is looked at much more closely since long-term debt commits a utility over the long term to pay interest and eventually to repay the borrowed amount. A greater percentage shows less financial flexibility and a greater possibility the utility may default on a loan. At the end of 1995, LVPL had financed 48 percent of its

total assets with long-term financing. Adding \$10,000,000 of debt would raise this percentage to 55 percent. The average 1994 percentage for utility cooperatives is 49 percent.

The third ratio, *Long-Term Debt to Total Capitalization*, indicates the extent to which the utility has used long-term debt in its permanent financing. If this percentage is high, the utility has less financial flexibility to meet its needs because it is locked into the interest payment on the debt. At the end of 1995, LVPL had obtained 60 percent of its permanent financing from debt sources. Adding \$10,000,000 debt increases this percentage to 67 percent. The average 1994 utility cooperative percentage is 47 percent.

The fourth ratio, *Total Debt to Total Capitalization*, is another measure of debt leverage. LVPL's ratio is 73 percent, while the average utility cooperative ratio is 50 percent. LVPL's ratio would increase to about 77 percent if LVPL finances another \$10,000,000.

The final ratio, *Times Interest Earned*, indicates a utility's ability to meet their interest payments out of their annual operating earnings. LVPL's ratio is 1.98. The average cooperatives' ratio is 1.97. Financiers frequently require utilities to maintain this ratio at 1.5 or greater.

More expensive alternatives (e.g., undergrounding transmission lines) increase these percentages further and decrease LVPL's ability for future borrowing. LVPL wants to make fiscal decisions that allows it to remain flexible and competitive in today's market.

► For Your Information

Cost estimates for these plans include all planning actions for each plan (not just the major actions identified here) and are in 1994 dollars while the agency proposed action and alternatives described earlier are given in 1997 dollars. Analysts studied the plans in this section in 1994 and assumptions about inflation, cost of equipment, interest rates, etc. are in 1994 dollars. The agency proposed action and alternatives were developed in late 1995 and 1996 and are in 1997 dollars. Because the plans in this section were eliminated, it was not cost-effective to update the cost estimates to 1997 dollars. A direct cost comparison of these plans and the agency proposed action and alternatives cannot be made.

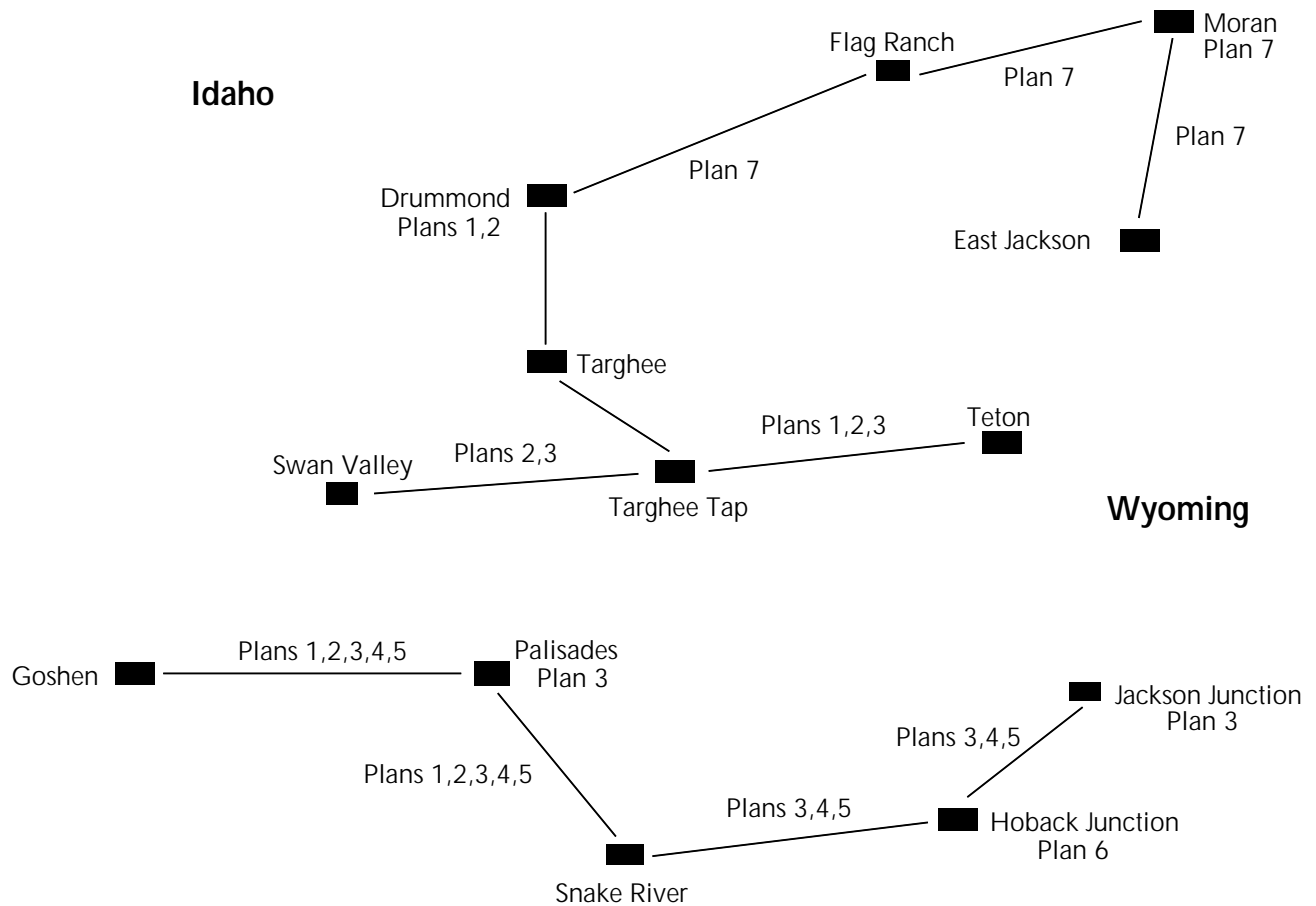
2.6.2.2 System Plans

This section describes the major actions of transmission system plans that were studied by BPA and LVPL, but eliminated from further consideration because of either the costs and/or transmission system reliability. These plans are shown schematically in Figure 2-5.

Plan 1 — This plan would rebuild the Targhee Tap-Teton transmission line to double circuit. This plan would cost about \$13,700,000 (**1994 dollars**).

Plan 2 — Plan 2 would rebuild the Swan Valley-Teton transmission line to double circuit. This plan would cost about \$16,200,000 (1994 dollars).

Plan 3 — Plan 3 would operate the southern corridor (through the Snake River Canyon), Palisades-Jackson Junction, at 161-kV. A new 161/115-kV transformer would be installed at Jackson Junction and Palisades. This plan would cost about \$21,500,000 (1994 dollars).

Figure 2-5. System Plans

Plan 4 — Plan 4 would rebuild the Palisades-Snake River-Jackson Junction 115-kV line (also the Snake River Canyon) to double circuit. This plan would cost about \$17,700,000 (1994 dollars).

Plan 5 — Plan 5 would build a new parallel second single-circuit line along the southern corridor (Snake River-Jackson Junction) and double circuit Palisades-Snake River. This plan would cost about \$15,600,000 (1994 dollars).

Plan 6 - Plan 6 would install series compensation (series capacitors) along the southern corridor at Hoback Junction. The amount of series compensation required to serve the full load during a line outage would cause overvoltages in both normal and outage conditions. The series capacitors could be distributed over several locations, which is technically feasible, but expensive. This plan was eliminated because it is technically complex making it too expensive.

Plan 7 — Plan 7 was suggested during the scoping period. In this plan, about 56 km (35 miles) of 115-kV line would be built from Drummond to Flag Ranch; about 48 km (30 miles) of 115-kV would be built from Flag Ranch to Moran Substation; and about 53 m (33 miles) of 69-kV line from Moran Substation to Kelly Substation to East Jackson would be rebuilt to 115-kV because the present spacing, insulation, conductor and structures are not capable of energization at 115-kV. Moran and Kelly substations would be converted from 69-kV to 115-kV. These stations are in Grand Teton National Park. About 32 km (20 miles) would be in the Grand Teton National Park and a large part of the line from Kelly to East Jackson would be in the National Elk Refuge. Part of the proposed line would be near the southern border of Yellowstone National Park.

When locating new transmission lines, BPA tries either to replace existing lines, or to use or parallel an existing transmission right-of-way. Following this right-of-way practice can greatly reduce costs and environmental impacts. For example, adding a transmission line next to an existing one can cause less visual impact than a new, totally separate line, and the need for new access roads can be kept to a minimum by using existing access roads.

This alternative may not work technically or would be less effective to meet the need compared to some other plans. It also requires more transmission line and would be more expensive than other plans. Potential environmental impacts to national parks could be high. This plan was eliminated from further consideration for these reasons.

2.6.3 Burying the Transmission Line

During the scoping process, many people suggested burying the proposed transmission line. Putting 58 km (36 miles) of transmission line underground is technically feasible.

The costs of burying a line are high and depend on terrain and soil conditions. Costs for undergrounding a line in flat, agricultural land, with deep soils and few outcrops are about \$870,000/km (\$1,400,000/mile) (1996 dollars). These estimates do not include costs for removing an existing line and putting that underground also, or any environmental, land, transition station or access road design costs.

While these costs are estimated for undergrounding in a flat area, the terrain crossed by most of the proposed line is rugged, especially near Teton Pass, with many steep and rocky areas. Costs to bury the line across this kind of terrain would be about \$1,180,000/km (\$1,900,000/mile). In comparison, the cost for building the overhead single-circuit 115-kV transmission line is about \$168,000/km (\$280,000/mile) (1996 dollars).

► For Your Information

A transition station is needed where a line changes from underground cable to overhead conductor. Typically, this kind of station requires a site about 37 m x 73 m (120 feet x 240 feet).

Building and maintaining a line underground has environmental impacts similar to a buried pipeline. For example, to create a trench to bury the cable, vegetation, soil and rocks would be removed along the length of the line. In areas where there is bedrock at the surface, such as Teton Pass, rock would likely need to be blasted. To cross streams such as Fish Creek, a trench would be excavated in the stream and covered, disturbing the creek bottom and affecting water quality. Construction equipment and activities would create noise, disturbing local residents near Teton Substation and Targhee Tap, and wildlife along the length of the line. Until vegetation is reestablished, disturbed areas along the line would be visible as would any new transition stations. New access roads would be needed for construction and maintenance of the buried line.

Visual impacts from blasting and from a new transition station would be greater than other alternatives. Impacts to water quality, fish, vegetation, wildlife, and populated areas could occur over the short and long term and, in some cases, could be more severe than paralleling an existing overhead line.

Burying and operating the transmission line underground was primarily eliminated from further consideration because of high costs.

2.6.4 Substation Locations for the SVC

BPA and LVPL considered Hoback Junction, Rafter J, East Jackson, Wilson, and Crystal substations as potential locations for the SVC. Because BPA does not own any of these substations, BPA does not have communication into these substations, making remote operation impossible. Maintenance also would be difficult. Because of location (in some cases next to steep slopes, rivers, backyards or roads), expansion of the existing substation yards would be difficult. In addition, Hoback Junction is located far from the main load center.

2.6.5 Local Generation

Building local **generation** was suggested during the scoping process. The Northwest Power Act prevents BPA from building or owning generation facilities. In the future, LVPL plans to operate as a combined electric and gas utility, making it possible for LVPL to build or own a gas generation facility. Included in LVPL's future natural gas plan is construction of a natural gas transportation pipeline into its service area, and a natural gas combustion turbine generating plant. Initial gas distribution is to be from a liquefied natural gas (LNG) pilot program in its service area. LVPL is just starting this program and results are uncertain. If this program is successful, LVPL may build the natural gas pipeline and combustion turbine plant.

As part of its planning process, LVPL looked at different locations for siting a natural gas combustion turbine. In 1992, an area between Alpine and Afton, Wyoming was studied but LVPL and BPA found that new generation in this area would only defer any transmission investment for 1-2 years. Conversely, siting a plant in or near the load center of Jackson, east of the Teton Range, would effectively eliminate the need to move more than 125 MW of power over the existing lines.

With the present load forecast, a 60 MW generation source in or near the Jackson area would delay the need for a new transmission facility about 10 years (about 2010). A 100 MW source of generation would delay the need to 2021. The cost of new generation (e.g., combustion turbine) would be many times the cost of the Agency Proposed Action, about \$10,000,000-10,500,000/10 MW unit.

Environmental impacts would depend on fuel source (e.g., nuclear, coal, natural gas) and the site of the generation plant. If located away from Jackson, new transmission lines and facilities would be needed to integrate the power into the local transmission system.

This alternative was dropped from further consideration because of high costs and the potential environmental impacts and challenges of locating generation facilities in the Jackson area.

2.7 Comparison of Alternatives and Summary of Impacts

This section compares all the alternatives described in this chapter using the project purposes from Chapter 1 and the predicted environmental impacts from Chapter 4. Tables 2-4 and 2-5 summarize the environmental impacts and compare the alternatives.

2.7.1 Agency Proposed Action

2.7.1.1 Environmental Impacts

This alternative was developed to meet environmental concerns expressed by the public and the USFS during scoping. Scenic vistas, winter and summer recreational use, and habitat disruption and recovery strongly influenced BPA and LVPL to create the new Agency Proposed Action. The addition of double-circuit structures and varying the location of new ROW makes the Agency Proposed Action more responsive to these concerns than other alternatives.

Construction, operation and maintenance activities would create levels of impacts that range from no impact to moderate impact for most resources. Agricultural land, timberland and rangeland would be taken out of production. Impacts would be low to moderate. Impacts to visual resources would generally be low or moderate, but high impacts would occur to visual resources at Teton Pass and near Teton Substation. Construction could interfere with recreation temporarily, and some roads open to public could be gated and closed after construction. Magnetic field levels near Teton Substation would decrease relative to the No Action Alternative. Impacts to water quality and soils range from no impact to high impacts and the degree is dependent on the type of soil affected and the success of erosion control measures. Erosion control measures would also be needed to protect wetlands. Impacts to vegetation would be moderate to high depending on the amounts cleared and the ability of an area to revegetate. Impacts to wildlife range from none to moderate. Bird collisions could be increased if **mitigation** measures are not used. Impacts to fish range from low to moderate and depend on impacts to stream turbidity. The potential to find cultural resources is low. Construction would create a positive impact on employment for the local economy. Impacts from vehicle emissions and construction dust are expected to be low.

In the Pine Creek area, three options included in the alternative respond to USFS concerns about wetlands, new access roads on steep slopes, and visual impacts.

Option A would avoid impacting wetlands. New access roads would be needed. Impacts to water quality and soils would be moderate to high. Option A would result in slightly greater impacts to visual resources than following the existing line. The line would be visible for a short distance along Highway 31, would add a cleared ROW in the area, and campers from the nearby day camp would view two rights-of way instead of one. Creating new ROW could impact hawk nests or other bird nests in cliff habitat.

Option B would also avoid wetlands, but new access roads would be needed. Construction would cause direct impacts including an increase in runoff and erosion and possible destabilizing of slopes. Impacts to soils would range from moderate to high depending on final design and location and the success of mitigation measures. Impacts would be reduced if access roads are not constructed and materials are delivered by helicopter or winched to structure sites. The new ROW would not create a high visual impact because the line would parallel the existing line. However, the rugged rocky cliffs would be slow to revegetate so the line would not be screened for a longer period. This option would remove fewer trees and would have fewer impacts to wildlife.

Table 2-5. Alternatives Compared to Project Purposes

Project Purposes or Objectives	Agency Proposed Action	Single-Circuit Line Alternative	Short Line Alternative	SVC Alternative	
Minimize negative impacts to the environment	Double-circuit structures help lessen impacts to some environmental resources.	Has the most environmental impacts of all alternatives.	No or low to high impacts on the environment but only on the Targhee Tap to Teton portion (the eastern part of Targhee and the Bridger-Teton National Forests).	Lower environmental impacts than line alternatives but impacts are more concentrated in a commercial and/or residential environment.	No disturbance to natural resources. Could have negative socioeconomic (including public health and safety) impacts depending on frequency, extent, and length of outages in winter.
Minimize costs while meeting BPA and LVPL's long-term transmission system planning objectives for the area	About a \$300,000 difference in both the up-front costs and the 30-year costs of this alternative and the Single-Circuit Line Alternative. This alternative is slightly more expensive.	About a \$300,000 difference in both the up-front costs and the 30-year costs of this alternative and the Agency Proposed Alternative. This alternative is slightly less expensive.	Least expensive of the line alternatives to build in 2000 (\$11,100,000). About the same costs as other line alternatives and less expensive than the SVC to meet long-term planning objectives (\$19,300,000).	Least expensive of the construction alternatives to build in 2000 (\$6,200,000) but most expensive if long-term planning objectives are to be met (\$20,100,000).	
Maintain BPA and LVPL transmission system reliability	Because of the double-circuit structures, this alternative is the second most reliable alternative after the Single-Circuit Line.	A new line on separate structures makes this the most reliable alternative.	Not as reliable as the Single-Circuit Alternative or Agency Proposed Action. Building a new line back to Swan Valley is needed by 2020 to maintain system reliability.	Emergency maintenance during winter could compromise system reliability. A new line would be needed in 2007 to maintain system reliability.	Does not maintain system reliability.

Option C would also avoid wetlands, but the new ROW would be more visible than the other options. This option would be more visible from Highway 31, particularly westbound. Also, a stream crossing and new access roads may be needed. Roads would be developed both on and off the ROW for this option, and existing roads would be used where practical. Impacts would be moderate and include increased erosion levels and runoff. Wetlands could be impacted by erosion created by construction of new roads if recommended mitigation measures are not successful. This option could create an additional hiking route around the south side of the day camp and could provide additional hiking access to Pine Creek at the new highway crossing. This option would increase the risk of avian collisions because there would be greater spacing between the existing and proposed lines.

The Underground Line Termination Option would reduce visual impacts somewhat to residences immediately adjacent to the substation. New equipment would be shorter than the equipment required for an overhead line and would be better screened by the fence and surrounding landscaping. There would be taller structures added just prior to the line going underground. This option would not impact recreation. Soil impacts would be primarily related to excavation activities to put the line underground from structure 36/4 to the line's end. About 4900-6100 m³ (6400-8000 yds³) of soil material (mostly within the existing substation) would be disturbed by the trench. The site is level and the risk of runoff and erosion is slight. The risk of off-site transport of sediment would be greatest during excavation and construction when soil is exposed. If turbidity is increased in tributaries to Lake Creek, there would be a localized, low impact to fish.

See Chapter 4 for more detail about impacts and recommended mitigation measures.

2.7.1.2 Reliability

The Agency Proposed Action is slightly less reliable than the Single-Circuit Line Alternative because some double-circuit structures would be used and separate lines on separate structures are safer in avalanche and slump prone areas. Steep terrain and extreme weather conditions in the project area combine to increase avalanche hazard and the certainty that both lines would go out of service if a double-circuit structure goes down. However, this alternative meets BPA's standards of providing power to LVPL with a high probability that power would be available when LVPL needs it.

► For Your Information

Line loss is the power lost during the transfer of power from one place to another. More power moved over a smaller number of lines increases line loss.

2.7.1.3 Cost

This alternative has fewer transmission **line losses** than most alternatives. This helps make the line more economical to build over the long term. There is an estimated \$300,000 difference in both up-front and long-term costs between the Agency Proposed Action and the Single-Circuit Alternative. Higher material and labor costs associated with double-circuit structures would make the up-front costs slightly higher. The margin of error present in the calculations to do the 30-year costs essentially makes the long-term costs about the same. Also, over a 30-year period this alternative would cost about the same to build as the Short Line and slightly cheaper to build than the SVC Alternative.

2.7.2 Single-Circuit Line Alternative

2.7.2.1 Environmental Impacts

Environmental impacts are similar to the impacts from the Agency Proposed Action. Slightly more land would be taken out of production permanently where the single-circuit structures are used instead of double-circuit structures. Magnetic fields would decrease on the south side and increase on the north side of the ROW relative to the No Action Alternative.

See Chapter 4 for more detail about impacts and recommended mitigation measures.

2.7.2.2 Reliability

This alternative is the most reliable of all the alternatives. It meets BPA's standards of providing power to LVPL with a higher probability that the power would be available when LVPL needs it. Separate lines on separate structures are safer in avalanche and slump prone areas.

2.7.2.3 Cost

This alternative also has fewer transmission line losses than most alternatives. This helps make the line more economical to build over the long term. Like the Agency Proposed Action, this alternative would be initially more expensive to build but over a 30-year period, it would cost about the same to build as the Short Line and slightly cheaper to build than the SVC Alternative.

2.7.3 Short Line Alternative

2.7.3.1 Environmental Impacts

Impacts would be similar to the Single-Circuit Line Alternative east of Targhee Tap. A new switching station built on agricultural land would permanently remove some land from production. The switching station would be located to minimize visual impacts. No recreation impacts are expected at the switching station. Magnetic fields would decrease on the south side of the ROW near Teton Substation and increase on the north side relative to the No Action Alternative.

See Chapter 4 for more detail about impacts and recommended mitigation measures.

2.7.3.2 Reliability

This alternative is not as reliable as the Agency Proposed Action or the Single-Circuit Line Alternative. Some reliability is compromised if the existing Swan Valley to Teton line goes down because power would need to flow north to Drummond and back down to Jackson. It is more reliable than the SVC Alternative.

2.7.3.3 Cost

The Short Line Alternative is a short-term fix to the problem. Though up-front construction costs are less than the Agency Proposed Action or the Single-Circuit Line Alternative, over the 30-year planning period it costs about the same to build the Short Line Alternative because by 2020, the line would need to be extended from Targhee Tap to Swan Valley Substation. Over 30 years, costs are less than the SVC Alternative.

2.7.4 SVC Alternative

2.7.4.1 Environmental Impacts

The SVC Alternative has the lowest overall environmental impacts and the impacts that do occur are concentrated in the residential and commercial areas that surround the substations under consideration. Visual impacts would be high to most residents surrounding Teton Substation. Impacts would be low at Jackson Substation because the substation is in a mixed use (residential and commercial) area. Noise would increase depending on background noise and equipment operation, but would stay within local standards. The potential to find cultural

resources is low. Socioeconomic impacts would be similar to the Agency Proposed Action. No impacts to land use, floodplains and wetlands, wildlife, fish, and air quality are expected.

See Chapter 4 for more detail about impacts and recommended mitigation measures.

2.7.4.2 Reliability

The SVC Alternative would be a short-term solution to the problem. This alternative may not be as reliable as the transmission line alternatives. Because the SVC Alternative consists of electrical equipment, there are more switching mechanisms and moving parts. This may require more emergency maintenance compared to a line that has more routine, scheduled maintenance. As a result, the line is more likely to be available when it is needed.

2.7.4.3 Cost

The SVC has more line losses than the other alternatives. It has significantly lower up-front costs than other alternatives but over the 30-year planning period it becomes the most expensive alternative because of the need to build a transmission line from Swan Valley to Teton Substation in 2007.

2.7.5 No Action Alternative

2.7.5.1 Environmental Impacts

The No Action Alternative would avoid all of the environmental impacts of the construction alternatives but commerce and industry would be negatively affected as the quality and reliability of power decreased. The socioeconomic and public health and safety impacts of this alternative would be immediate and more negative than the other alternatives.

2.7.5.2 Reliability

The No Action Alternative is the least reliable alternative and would lead to voltage collapse if a critical line is lost on the system. Collapse of the system could continue over a long period (hours or even days) if outages occur in winter when deep snows make access to the existing transmission system difficult.

2.7.5.3 Cost

Depending on the frequency, duration, and extent of blackout conditions in the area, this alternative could be the most costly in the long run.

